

CLAIMS

1. A light diffraction method using a diffraction grating, wherein:
the diffraction grating comprises:

5 a first layer containing two or more first light scatterers, two or more of which being periodically arrayed along a first direction and either a) two or more of which being arrayed along a second direction or b) extending along the second direction; and

10 a second layer containing two or more second light scatterers respectively corresponding to the two or more first light scatterers, the two or more second light scatterers being disposed at positions shifted from the two or more first light scatterers by a predetermined distance along a predetermined direction in a plane that is other than a plane containing the first direction and the second direction;

15 the method comprising:

making light incident on the diffraction grating so that:

in a case of a), the light is incident along a plane containing two or more trajectories selected from trajectories formed by the shifting of the two or more first light scatterers in the predetermined direction; and

20 in both cases of a) and b), specular resonance occurs in two or more light scattering units, each comprising one light scatterer selected from the two or more first light scatterers and one of the second light scatterers corresponding to the selected one of the first light scatterers,

25 whereby a fraction of diffracted light that is diffracted by the first layer and the second layer is enhanced selectively by the specular resonance in the two or more light scattering units.

2. The light diffraction method according to claim 1, further comprising the step of changing at least one selected from a relative positional
30 relationship between the first layer and the second layer, and an incident angle of light on the diffraction grating, to change diffracted light that is to be enhanced selectively.

3. The light diffraction method according to claim 1, wherein diffracted
35 light with a single order is enhanced selectively.

4. The light diffraction method according to claim 1, wherein diffracted

light in a predetermined wavelength range is enhanced selectively.

5. A light diffraction device comprising:

5 a diffraction grating and a light projecting device, the diffraction grating comprising:

a first layer containing two or more first light scatterers, two or more of which being periodically arrayed along a first direction and either a) two or more of which being arrayed along a second direction or b) extending along the second direction; and

10 a second layer containing two or more second light scatterers respectively corresponding to the two or more first light scatterers, the two or more second light scatterers being disposed at positions shifted from the two or more first light scatterers by a predetermined distance along a predetermined direction in a plane that is other than a plane containing the
15 first direction and the second direction;

the light projecting device being for making light incident on the diffraction grating so that:

in a case of a), the light is incident along a plane containing two or more trajectories selected from trajectories formed by the shifting of the two
20 or more first light scatterers in the predetermined direction; and

in both cases of a) and b), specular resonance occurs in two or more light scattering units, each comprising one light scatterer selected from the two or more first light scatterers and one of the second light scatterers corresponding to the selected one of the first light scatterers,

25 whereby a fraction of diffracted light that is diffracted by the first layer and the second layer is selectively enhanced by the specular resonance in the two or more light scattering units.

6. The light diffraction device according to claim 5, further comprising a
30 driving device for changing at least one selected from a relative positional relationship between the first layer and the second layer, and an incident angle of light on the diffraction grating.

7. The light diffraction device according to claim 5, further comprising at
35 least one light detection device for detecting diffracted light that has been enhanced selectively.

8. A position encoding device, comprising a light diffraction device according to claim 7, a first member, and a second member, wherein:

the first member and the second member are connected to the first layer and the second layer, respectively, and

the at least one light detection device detects the intensity of diffracted light that changes according to relative positions of the first layer and the second layer, to detect the relative positional relationship between the first member and the second member.

9. A diffraction grating comprising:

a first layer containing two or more first light scatterers, two or more of which being periodically arrayed along a first direction and either two or more of which being arrayed along a second direction or extend along the second direction; and

a second layer containing two or more second light scatterers respectively corresponding to the two or more first light scatterers, the two or more second light scatterers being disposed at positions shifted from the two or more first light scatterers by a predetermined distance along a predetermined direction in a plane that is other than a plane containing the first direction and the second direction;

wherein the diffraction grating has two or more light scattering units, in each of which one light scatterer selected from the two or more first light scatterers and one of the second light scatters corresponding to the selected one of the first light scatters are disposed adjacent to each other so that incident light can cause specular resonance; and

the two or more first light scatterers and the two or more second light scatterers respectively in the first layer and the second layer are disposed spaced apart from each other.

10. The diffraction grating according to claim 9, further comprising a first substrate for retaining the two or more first light scatterers, a second substrate for retaining the two or more second light scatterers, and a gap-retaining member for retaining the first substrate and the second substrate so as to be spaced apart from each other.

11. The diffraction grating according to claim 9, further comprising a driving device for changing the relative positional relationship between the

first layer and the second layer.

12. A diffraction grating comprising:

5 a first layer containing two or more first light scatterers, two or more of which being periodically arrayed along a first direction and either two or more of which being arrayed along a second direction or extend along the second direction; and

10 a second layer containing two or more second light scatterers respectively corresponding to the two or more first light scatterers, the two or more second light scatterers being disposed at positions shifted from the two or more first light scatterers by a predetermined distance along a predetermined direction in a plane that is other than a plane containing the first direction and the second direction;

15 wherein the diffraction grating has two or more light scattering units, in each of which one light scatterer selected from the two or more first light scatterers and one of the second light scatters corresponding to the selected one of the first light scatters are disposed adjacent to each other so that incident light can cause specular resonance;

20 the two or more first light scatterers and the two or more second light scatterers are disposed so as to be in contact with each other; and

25 at least one selected from the two or more first light scatterers and the two or more second light scatterers has a shape other than a sphere, or both the two or more first light scatterers and the two or more second light scatterers are spheres but are disposed so as to form a structure other than a close-packed structure.

13. The diffraction grating according to claim 12, wherein the two or more first light scatterers and the two or more second light scatterers are columnar structures extending along the second direction.

30 14. A light diffraction device comprising a diffraction grating according to claim 9 or 12, and an optical component integrated with the diffraction grating.